

**EPIONE PARALELLARIA D. & S. (LEP.: GEOMETRIDAE) AND ITS
ASSOCIATION WITH ASPEN *POPULUS TREMULA* IN THE
SCOTTISH HIGHLANDS**

¹ROY LEVERTON, ²MARK R. YOUNG AND ³DAVID A. BARBOUR

¹Whitewells, Ordiquhill, Cornhill, Banffshire AB45 2HS.

²Culterty Field Station, Newburgh, Ellon, Aberdeenshire AB41 0AA.

³125a High Street, Aberlour, Banffshire AB38 9PB.

THE DARK BORDERED BEAUTY *Epione paralellaria* is a very local species in Britain. Shirt (1987) accorded it RDB 3 status: "Rare". At present, there are post-1980 records from only four 10km squares. Waring (*in press*) gives details of its current distribution, and revises its status to RDB 2: "Vulnerable". It seems to be confined to a handful of widely separated sites in the north of England and in Scotland, most of which have long been known, where it forms discrete colonies. The few individuals reported from southern England, if genuine, are thought to be migrants or strays. Presumably the species has very exacting requirements, or it is a poor coloniser; perhaps a combination of both factors applies.

The historical background

The named localities given in South (1907) comprise two mosses and two bogs, so the moth has always been linked with damp habitats. The main foodplant at its sites in the north of England, and in southern Scotland too, is considered to be dwarf willow *Salix repens*. Hewett (in Tutt, 1902) described how larvae could be obtained at the Yorkshire sites by sweeping dwarf willow in June, and the females found resting on that plant in July. Sadler (1975) describes the finding of 13 small larvae on dwarf willow in June 1974 at a site in southern Scotland (presumably Adderstonlee Moss, Roxburghshire). More recently, M. Britton has found larvae at Strensall Common, Yorkshire, only on *S. repens*, and never on any other *Salix* species or on the small birches *Betula* which are also present (H.E. Beaumont, *in litt.*), although these are cited by most authors as alternatives, or as occasionally used (eg. Emmet & Heath, 1992).

The history of *E. paralellaria* in the Scottish Highlands is not clear-cut. South (1907), quoting Salvage, describes the moth as widely distributed in Sutherlandshire, but this is now thought unreliable. The first incontrovertible record of its occurrence in the Highlands came only in 1953, when E.C. Pelham-Clinton took seven males at light at Speybridge, and suggested that they were associated there with aspen *Populus tremula*, not dwarf willow. This site is usually given as being in Inverness-shire, but is actually in Moray in terms of the Watsonian vice-county boundaries. (How many entomologists realise that the village of Aviemore itself is in VC95, Moray, and not VC 96, East Inverness-shire?)

Then, in or around 1968, W. McWilliam discovered a colony of *E. paralellaria* near Balmoral on Deeside, but the find was not published. Following his directions, R.M. Palmer and MRY confirmed the moth's presence in 1975, and added it to the Aberdeenshire list (Palmer & Young, 1977). Intriguingly, while transcribing data labels from a collection (now destroyed) made by a Mr Catto in Aberdeenshire around the end of the 19th Century, DAB found two undated specimens of *E. paralellaria* labelled "B-mar" – almost certainly Braemar, and conceivably the same Balmoral site. If so, its existence on Deeside was not known to the Aberdeenshire recorders of the time such as Reid (1893) or later collectors such as Duncan in the 1920s-1940s, who collected extensively in the Braemar area.

Ecology of the Highlands sites

The moth is apparently confined to a relatively small area at the Balmoral site, which superficially seems no different from many other places on Deeside, or elsewhere in the Scottish Highlands. It is sheltered, and runs alongside a burn, but is not especially wet, and *S. repens* is almost certainly absent. Instead, *E. paralellaria* is associated with aspen. In particular, it is found amongst small and stunted aspen bushes about one to two metres high, arising from suckering, and low growth springing up where taller trees have been felled.

A visit was made to this colony by MRY and RL in the early evening of 30.vii.1994. The weather was still, overcast and warm. *E. paralellaria* was the most numerous moth seen. Males were easily disturbed from the low aspens and surrounding herbage such as bracken. The female is said to be sluggish, and rarely found (Hewitt, *loc. cit.*; Skinner, 1984), but at least six were noted, two of which were resting low down on fenceposts, and others sitting fairly openly in the vegetation. As the colony was clearly having a good year, one female was retained for eggs by MRY, with the aim of discovering more about the species' requirements in the early stages.

The Speybridge area is also characterised by the presence of aspen, but we could not trace any records of *E. paralellaria* there subsequent to its 1953 discovery. Indeed, there appears to be only one further record for Speyside: a casual single specimen in 1975 at Aviemore (Wild, 1975). Accordingly, an attempt to refind the moth at Speybridge was made in 1994 by DAB and Dr Paul Waring. This was unsuccessful, and it was noted that, although aspen was still present, the trees were now mostly tall and mature. Further searches by DAB proved equally fruitless, until he and RL found three (possibly four) males in aspen woodland on 11.viii.1996. The first was resting low down on an aspen bole, and the others disturbed from foliage. Significantly, the moths were found only in a small part of the woodland, where the aspens were producing suckers, even though these were less than 0.5 metres tall. As with the Balmoral site, the habitat was sheltered and near a stream, but not wet; *S. repens* was apparently absent.

Captive breeding

Eleven of the eggs laid by the Balmoral female were passed to RL, with about two dozen kept by MRY. They were overwintered in unheated outbuildings. Those held by RL did not begin to hatch until 28.v.1995 – a wise precaution this far north, where cold springs often delay leafbreak. Formal descriptions of the larval instars are given later.

Young leaves of aspen were provided for the newly hatched larvae, this being the presumed foodplant at the Balmoral site. They were eaten readily. Aspen being in short supply, RL also provided tender leaves of birch, and of willows *Salix aurita* and *S. cinerea*, but all were untouched. Larvae reared by MRY even refused Italian Poplar *P. serotina*. Later, MRY had cause to transport his larvae to an area of Yorkshire where aspen was unavailable, but foresaw no problem because *Salix repens* was common there. Surprisingly, the Balmoral larvae refused to eat this, even when no other food was available and they were in danger of starving. Supplies of aspen had to be obtained urgently by post, whereupon the larvae resumed feeding. RL also offered *S. repens* to his larvae with the same result, except that a small part of one leaf was eaten initially, but none was touched after that.

The ten larvae reared by RL (one having died from injury soon after hatching) were closely observed throughout their development. Some interesting behaviour was noted. During the first three instars, but not afterwards, the larvae spent most of their time when not feeding suspended from the twigs of their foodplant by a silk thread. The length of this thread was fairly constant, being roughly one and a half times that of the larva. At any one observation, an average of eight of the ten larvae would be suspended in this way. Caterpillars of many species will drop and hang by a thread if disturbed, so great care was taken to establish that this was not happening with the *E. parallellaria* larvae, and they were not reacting to any vibration or the observer's shadow. This was ruled out. On the contrary: any disturbance had the opposite effect, causing the larvae to climb rapidly up the silk and regain the twig. Piles of frass clustered immediately below each larva proved they had been hanging in the same place for some time. They fed mainly at night.

Occasionally, a larva was seen hanging head-downwards from its silk. Such larvae appeared ready to moult. Eventually, ecdysis from the second to the third instar, while the larva was still suspended, was observed. The old skin split dorsally behind the head in the usual way, and rhythmic movements caused it to concertina upwards towards the tail. Just as it seemed that the larva must surely fall, being almost free of the old skin, it looped up to grasp the thread of silk with its thoracic legs. Next, it seized the old skin in its jaws, pulling it off the anal claspers. Still holding the bundle of old skin, it climbed the silk back onto the twig, where the old skin was deposited. Whether this is the normal method of ecdysis in the early instars

is unknown, but other larvae were seen hanging head-downwards without the full process being observed.

The captive larvae ate relatively sparingly, yet grew quickly. They were ready to pupate in a little over three weeks. The rather slight cocoons of brownish silk were spun in surface debris or between dead leaves. Moths emerged about three weeks after pupation, always at night. They were normal in size and appearance.

Not being able to release them at the original site, RL placed five females and two males in a large container. They were supplied with aspen foliage and twigs, and fed with a sponge soaked in sugar solution. Mating was observed on several occasions. The females all lived 14-15 days, and the males 16 and 17 days. At first it seemed that few eggs had been laid, but when the container was emptied, it was found that nearly all had been laid on the twigs at the bottom of the pile, and in the darkest corners, with none on the exposed, uppermost twigs. Shrivelled fern leaves had also been used. If repeated in the wild, such behaviour would suggest that eggs are laid amongst ground litter, and perhaps dead bracken, rather than on the living twigs of the foodplant. On two occasions in autumn, in 1990 and 1994, MRY had searched the aspen bushes at the Balmoral site for eggs of *E. paralellaria* with success, even though he was familiar with the characteristic colour and appearance of the eggs by the time of the second visit.

The five dead females were dissected, and found to be completely spent. Two contained no unlaidd eggs, two contained a single egg, and the fifth had two unlaidd eggs. Those which had been laid were carefully counted, giving a total of 598 – a rough average of 120 eggs per female.

In spite of the imbalance of the sexes, only about 4% of the eggs were obviously infertile from their appearance when checked the following April. The eggs were later taken back to the original site by DAB.

The finding of larvae in the wild

The insistence on aspen by the captive larvae lent weight to the assumption that this was the foodplant at the Balmoral site. To confirm it, DAB beat low aspens there on 1.vii.1995, and eventually found three *E. paralellaria* larvae, each in a different instar from third to last.

Discussion

In the Scottish Highlands, *E. paralellaria* has different foodplant from that used at its other British colonies, and occupies a different habitat. Although *Salix repens* is widespread in the Highlands, it seems not to be used there, and captive larvae refused to eat it even when starving. Instead, the moth requires aspen thickets where the growth is low and scrubby, as occurs where the trees are producing suckers. Possibly the need for low sheltered bushes results from the larva's habit, in the early instars, of hanging from a

silk thread for long intervals when not feeding. This may help it to avoid parasites or predators. Such a tactic would be impossible on tall, windswept trees. Also, if the eggs are laid on ground debris, as is suggested by the behaviour of captive females and our failure to find eggs on living aspen twigs in the wild, the newly-hatched larvae may have a better chance of reaching the leaves of their foodplant in low, dense growth, rather than in tall, more widely-spaced woodland.

Both Deeside and Speyside have been relatively well-worked since Victorian times, yet this distinctive and attractive moth was presumably overlooked there until comparatively recently. Even after its discovery at Speybridge in 1953, there were no further records from that area for over 40 years, and it took several expeditions by observers familiar with the species at its Balmoral site before the moth was refound.

Many of the sexually dimorphic Ennominae with fully-winged females are at least partially diurnal, and this behaviour is well-documented for *E. paralellaria* by Hewett (*loc. cit.*), who describes an early morning flight by the males between 6am and 9am. Thus light trapping may not be particularly effective for this species, given also that the females are sluggish, compared with daytime searching of likely habitat. We consider it probable that further colonies of *E. paralellaria* will be discovered in the Highlands once the connection with aspen, rather than dwarf willow, is more widely recognised. In flight by day, slightly worn males can resemble the ubiquitous Yellow Shell, *Camptogramma bilineata* L. so it is well worth investigating any small yellow geometer seen near aspen in Scotland, especially between late July and mid-August.

Descriptions of the early stages

Eggs

Of the usual geometrid lozenge shape, pale cream, soon changing to a deep, bright pinkish orange. In captivity, laid on dead twigs in small, irregular clusters, resembling slightly the coral spot fungus *Nectria cinnabarina*.

Overwintering; shortly before hatching becoming purplish-grey.

Larva

Newly hatched, before feeding: long and slender, strikingly patterned for a first instar larva, being dirty white, with a broad, dark grey-brown dorsal stripe and similar, slightly less broad, ventral stripe. Head rounded, pale brownish-yellow. The pattern becomes more diffuse as the larva grows, the sides becoming pale greenish-white and the dorsal and ventral areas dark greenish-grey.

Second and third instars: Contrast between dark dorsal and ventral stripes and pale sides now less sharp, due to each having fine, wavy, longitudinal striations of the opposite colour. Spiracles and warts small and black,

inconspicuous. The most noticeable feature is a comma-shaped mark, intensely brownish-black, on each side of the second abdominal segment. It is set in a slight depression, and roofed along its convex upper edge by a ridge or fold of skin, displacing the spiracles upwards. Because of these structural features, RL considers it might be some sort of gland, perhaps with a defensive function. Head, pale brown with dark brown spots.

The bicoloured, striped pattern of the first three instars corresponds with the stage when the larva hangs suspended from a silk thread when not feeding.

Fourth instar: More twig-like; still with dorsal and ventral areas darker than the sides, but with a less clear-cut division. The sunken mark on the sides of the second abdominal segment is now less conspicuous due to additional dark marking dorsally on that segment.

Fifth (final) instar: Long and slender, tapering evenly from tail to head, apart from a knuckle-like bulge on the second abdominal segment, emphasised by black dorsal and lateral marking. Dorsal surface grey-brown, tinged violet, with fine, wavy, longitudinal striations both paler and darker. A raised white dot, partially outlined with black, subdorsally on each segment, and several smaller black warts each bearing a short fine bristle. Sides, dull purplish red; spiracles small and black, indistinctly ringed whitish. Subspiracular line not sharply demarcated, pinkish-white blotched with pale yellow, continuing down the side of the proleg on abdominal segment 6, and edged there with black. Ventral surface pale grey, tinged yellow and pink, and striated paler and darker; a black oblong or X-shaped blotch, increasingly heavy, on abdominal segments 3-6. Thoracic legs whitish, marked with black. Head sloping, small and rounded, pale greyish, heavily spotted dark brown, with pale mark across frons. Full-grown length c.26mm.

Although some of the colours themselves are bright, they merge and blend to give the larva a procryptic, twig-like appearance. It rests at an angle to the stem of its foodplant, with the abdomen straight, but the thoracic segments and head gently curved backwards away from the stem. Each pair of thoracic legs then forms a separate tooth in a serrated profile.

Acknowledgements

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Notable ant records from Glen Strathfarrar, East Inverness

Glen Strathfarrar National Nature Reserve (2189 hectares) occupies the lower part of Glen Strathfarrar, East Inverness (VC 96). The heavily glaciated valley has steep slopes where relatively extensive tracts of Caledonian pine forest, and birch woodlands have survived. In the valley bottom, the tree cover, in combination with free draining fluvio-glacial deposits, have created ideal conditions for a number of ant species.

Mixed nests of *Formica lemani* and *Formica sanguinea* were seen in many areas where there was sandy and stony ground adjacent to trees. Glen Strathfarrar provides the beginnings of the link between the populations of *F. sanguinea* to the north at Migdale Wood (Hughes, 1994), and those in Glen Affric to the south. It is possible that *F. sanguinea* survives in other fragments of ancient birchwoods in the Glens of East Inverness and East Ross although I am yet to find any colonies. *Myrmica sabuleti*, *M. lobicornis*, and *Lasius flavus*, *Lasius niger* agg. were all frequent amongst similar habitat along the valley bottom.

In addition, the woodlands along the first six miles of the Glen support a thriving population of *F. aquilonia* which, with the woodland management initiatives developed by Scottish Natural Heritage, are set to fare well in the coming decades.

– JONATHAN HUGHES, 11a King St, Embo, Sutherland IV25 3PU.

Pontia daplidice (Lep.: Pieridae) in Kent, *Argynnis lathonia* (Lep.: Nymphalidae) in Gloucestershire, and some other 1996 migrant records

Ever since childhood I have been scanning, without success, *Buddleia* bushes for something a bit rarer than the usual vanessid or pierid. It is therefore with a slight degree of chagrin that I have to report that it was my father, Dr Albert Woiwod, rather than myself, who was fortunate enough to see a Bath White *Pontia daplidice* L. in such circumstances. It was in his